THE UNIVERSITY OF ALBERTA

BENDER GESTALT LINKAGE CONSISTENCY IN CHILDREN

by

© DONNA M. KNIGHT

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS

DEPARTMENT OF PSYCHOLOGY

EDMONTON, ALBERTA

SPRING, 1972

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "Bender Gestalt Linkage Consistency in Children" submitted by Donna M. Knight in partial fulfilment of the requirements for the degree of Master of Arts.

ABSTRACT

The present study examined the consistency with which nine sets of properties shared by two or more Bender Visual Gestalt Test designs were reproduced. Consistency was analyzed from two points of view: first, consistency or deviation in each property reproduction from the property as it appears on the stimulus card; second, consistency or deviation from the initial reproduction of each property in subsequent reproductions. This resulted in 18 measures of consistency which were examined developmentally and as possible indicators of maladjustment in children aged 8 to 14. It was hypothesized, first, that maladjusted children would show greater inconsistency in the property reproductions than would children who were not maladjusted. Secondly, it was hypothesized that consistency would be age dependent, with property reproductions of older children showing greater consistency than those of younger children. Additionally, the study was designed to permit an examination of possible sex differences and interactions between adjustment age and sex factors. Twenty (10 male and 10 female) adjusted and twenty (10 male and 10 female) maladjusted children were selected from each of three age groups (8 to 10, 10 to 12, 12 to 14) to give a

total sample of 60 adjusted and 60 maladjusted subjects

Results strongly supported the first hypothesis. Maladjusted subjects showed significantly greater inconsistency (reflected in higher deviation scores) for 17 of the 18 measures of consistency. Results with respect to the second hypothesis were less clear cut. In view of the highly significant relationship obtained between consistency and maladjustment, developmental effects were examined separately for adjusted and maladjusted subject. For the adjusted subjects the older group generally showed greater consistency than one or both of the younger age groups while with maladjusted subjects no significant age group differences were found. The findings regarding sex differences in consistency between maladjusted and adjusted subjects was greater for males than females. Limitations of the present study were discussed and suggestions made for further research.

ACKNOWLEDGEMENTS

The support and guidance offered by the writer's supervisor, Dr. D. Spearman, throughout this project was deeply appreicated as were the helpful comments of Dr. A. G. Scott and Dr. B. Sinha who served as members of the examining committee.

Special thanks are due to Miss Toni Ryan for her generous and valuable assistance in the computer processing of the data and constructive criticisms during the preparation of the thesis.

The cooperation and financial support provided by the Glenrose Hospital made possible the research project on which this thesis is based. Thanks are also expressed to the teachers and administrative staff in the Camrose Public Schools, particularly to Mr. J. Stuart and Mr. J. Murray, for their cooperation in arranging for students to serve as subjects in the study.

Finally, thanks are expressed to my husband, George, for his patience and encouragement throughout the project and to Mrs. Laura Zornes for her competent and efficient typing of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The Bender Visual Motor Gestalt Test (BVMGT) consists of nine individual designs which a subject is required to copy on a blank sheet of paper. The designs are based upon those originally used by Wertheimer (1923) to demonstrate the principles of Gestalt Psychology as related to perception. Wertheimer had his subjects verbally describe their perceptions of the figures. Bender (1938) adapted these designs and used them as a visual motor test in relation to the study of personality and clinical practises. She (Bender, 1938) pointed out that the perception and reproduction of the Gestalt figures are determined by biological principles of sensory motor action and vary depending on (a) the growth and maturation level of an individual and (b) his pathological state either functionally or pathologically induced.

To date, most investigations of the BVMGT have been concerned with the accuracy of the reproductions of each of the individual designs. It has been noted (Spearman, 1970[1]), however, that there are identical properties

---

[1] D. Spearman, personal communication, May, 1970.

throughout the designs which make possible an investigation of the consistency of sequential reproduction of the properties of the test designs.

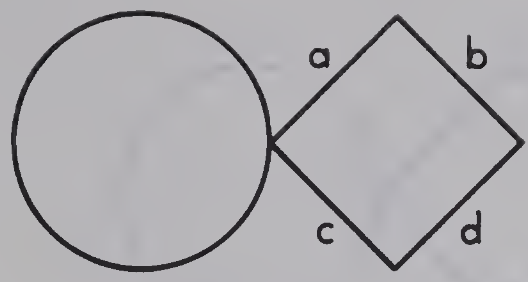
Although there are no properties which are common to all the designs, there are consistencies between some of them.

1. Designs A, 4, 7, and 8 each contain lines of identical length. These are (a) the length of the sides of the square in design A; (b) the sides of the square in design 4; (c) the lines forming the acute angles of the hexagon in design 7; and (d) the lines forming the acute angles of the hexagon in design 8 (Figure 1).
2. The circular features in designs A, 4 and 5 have identical diameters (Figure 2).
3. Designs 3, 4 and 8 share (a) the length of the central row of dots (axis) in design 3; (b) the distance between the tails of the curved figure in design 4; and, (c) the length of the horizontal sides of the hexagon in design 8 (Figure 3).
4. Designs 5, 7, and 8 share (a) the length of the extension in design 5: (b) the length of the longer sides of the hexagon in design 7;

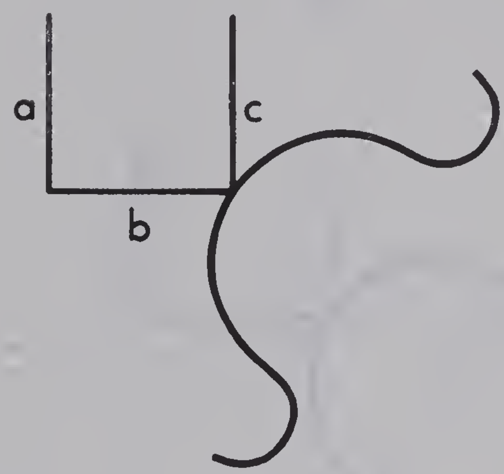
and, (c) the lengths of the halfsides (longer sides) of the hexagon in design 8 (Figure 4).

5. The length of the row of dots in design 1 and the length of the horizontal rows of ovals in design 2 are identical (Figure 5).
6. Designs 4 and 6 share (a) the distance between the centres of the arms of the curved figure in design 4; and, (b) the distance between the apexes of the first and third curvatures and the second and fourth curvatures of the vertical wavy line in design 6 (Figure 6).
7. The length of the sides forming the obtuse angles of the hexagon in design 7 and the length of the sides of the diamond in design 8 are identical (Figure 7).
8. The size of the obtuse angles of the hexagons in design 7 and the obtuse angles of the diamond in design 8 are equal (Figure 8).
9. The size of the acute angles in the hexagons in design 7 and the acute angles in the hexagon in design 8 are identical (Figure 9).

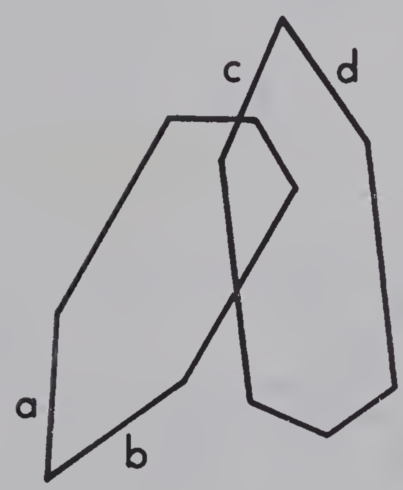
These nine sets of common properties are referred to as linkages.



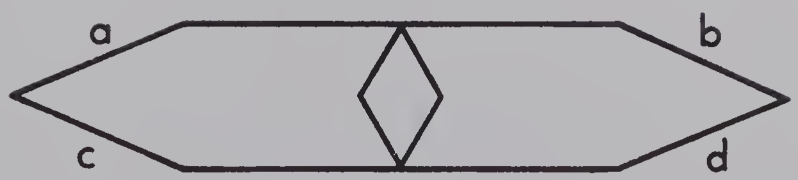
A



4

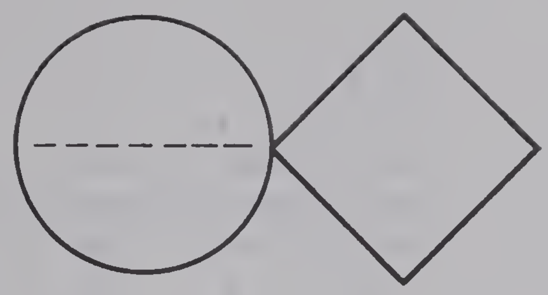


7



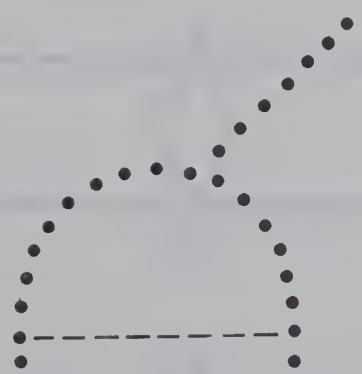
8

Figure 1: Linkage 1



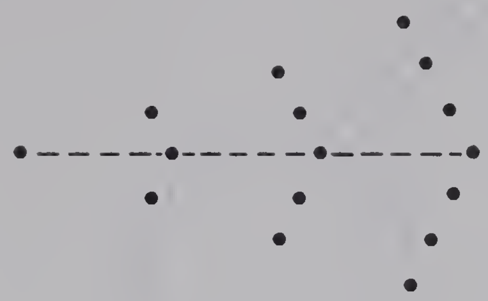
A

4

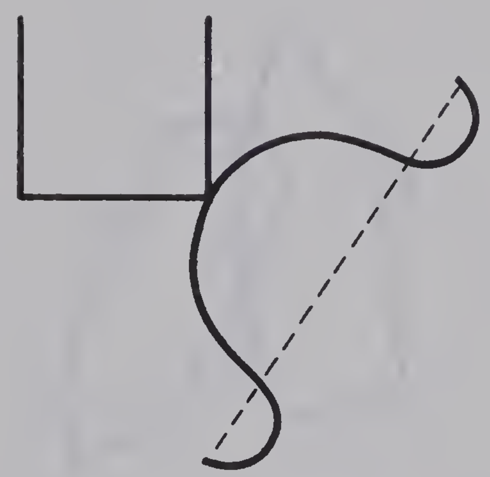


5

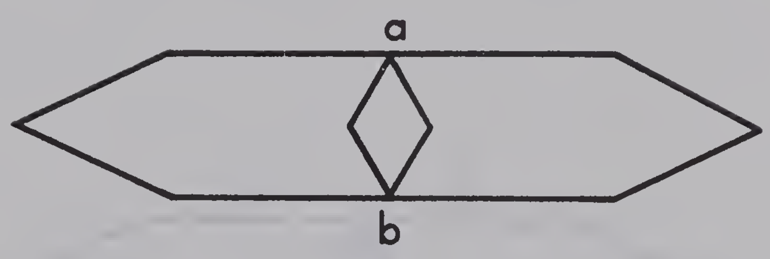
Figure 2: Linkage 2



3

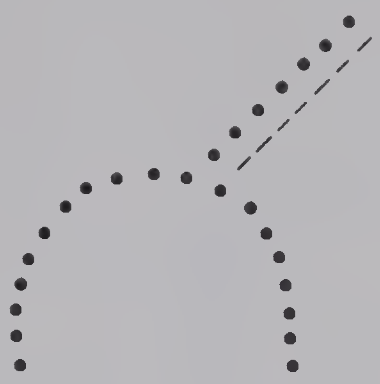


4

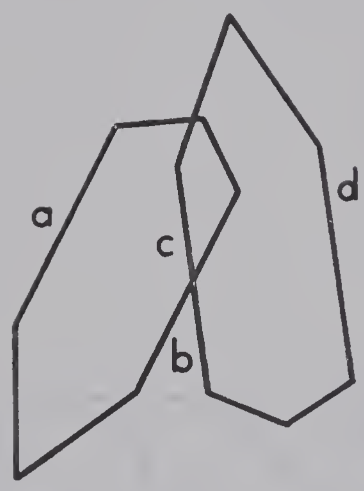


8

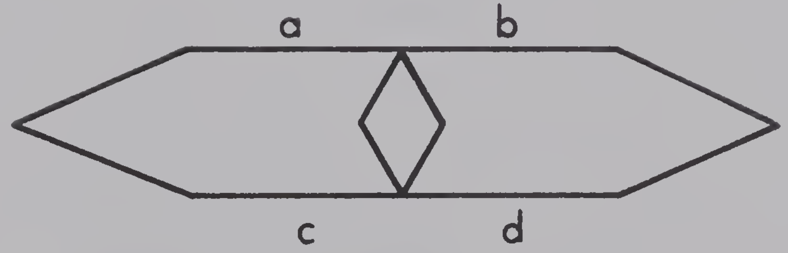
Figure 3: Linkage 3



5



7



8

Figure 4: Linkage 4

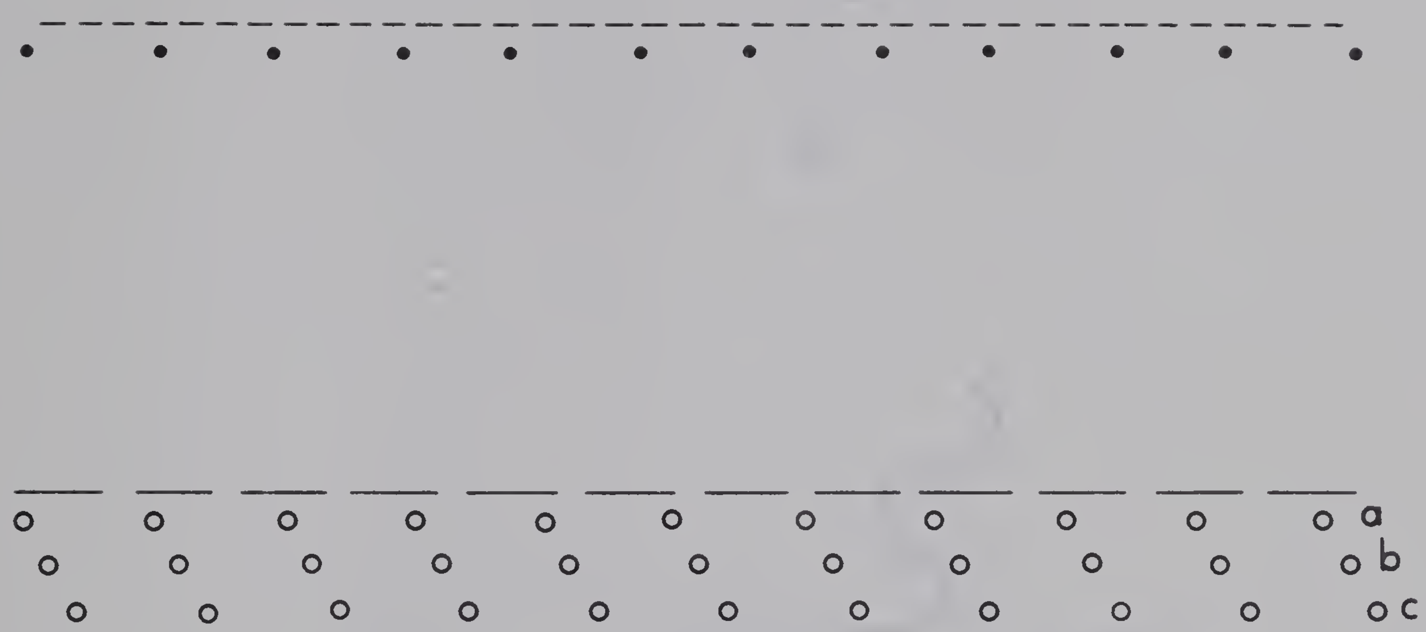
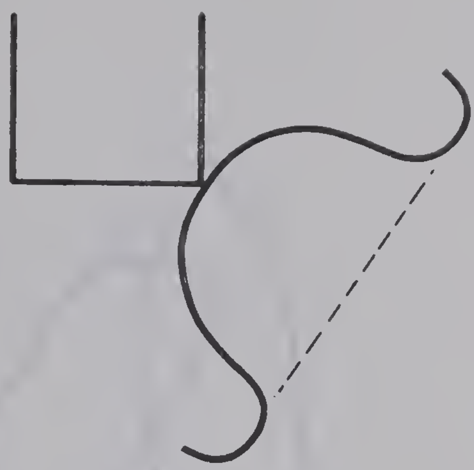
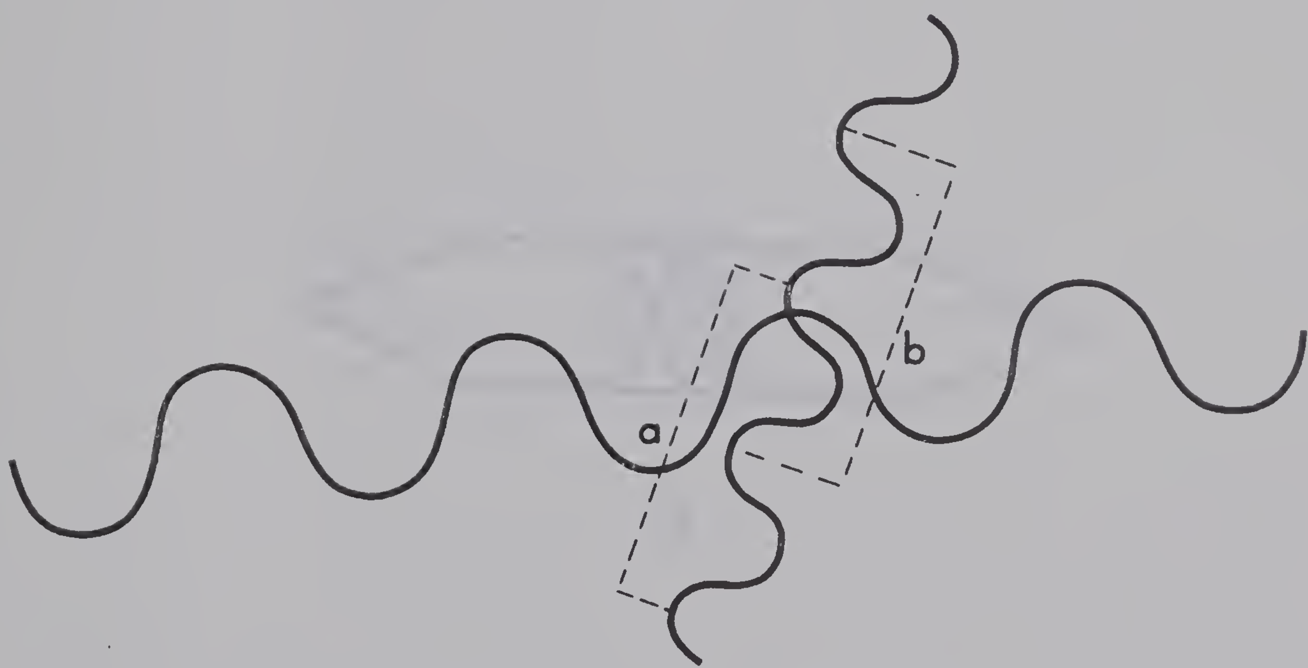


Figure 5: Linkage 5

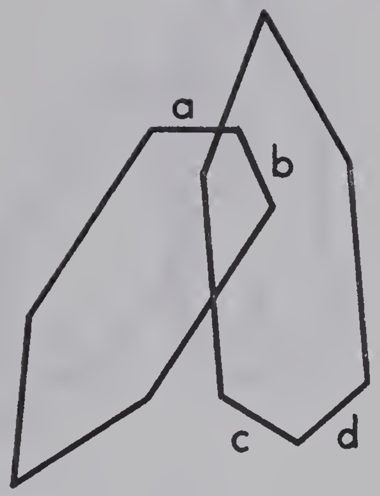


4

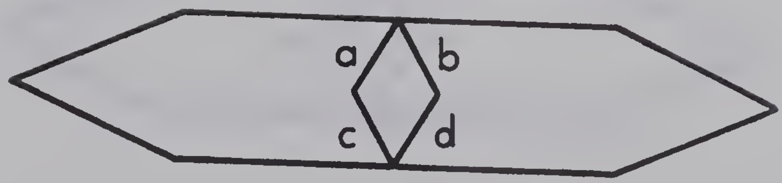


6

Figure 6: Linkage 6

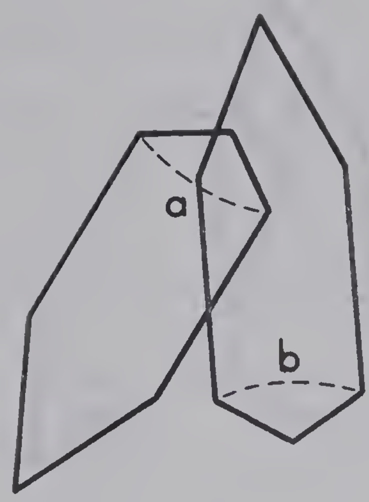


7

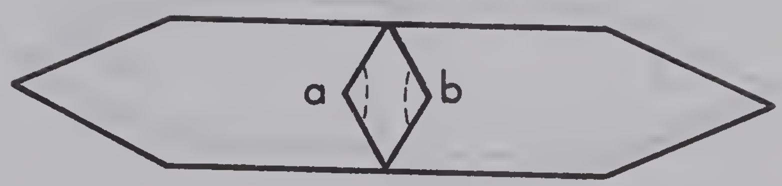


8

Figure 7: Linkage 7

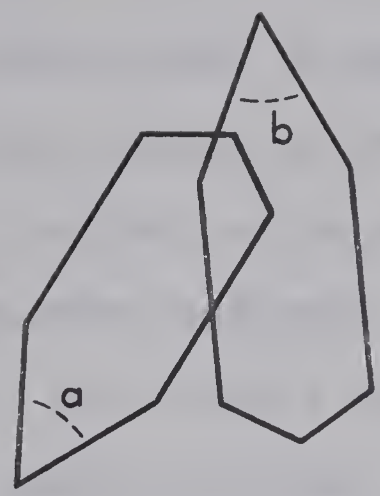


7

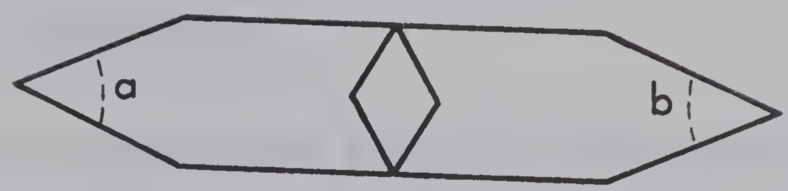


8

Figure 8: Linkage 8



7



8

Figure 9: Linkage 9

The consistency of subject reproductions of the design properties was analyzed from two points of view: first, consistencies or deviations in each reproduction from the properties as they appear on the stimulus card; second, consistencies or deviations in each linkage (or property shared by two or more designs) in the reproductions. More specifically, the initial reproduction of any property served as the standard against which subsequent reproductions of that property were compared for consistencies or deviations. The present study sought to examine consistency of BVMGT reproductions from a developmental standpoint and as a possible indication of maladjustment.

Overview of the Literature

Within the extensive body of literature concerned with the Bender Gestalt, only a few studies have related in any way to the questions which the present research was designed to examine. There is some evidence to suggest that specific types of deviations occurring in the reproduction of the BGT designs can differentiate between children who are maladjusted and those who are not. Byrd (1956) attempted to determine which Bender factors differentiated children requiring psychotherapy from well-adjusted children. Fifteen of Hutt's (1953) factors were selected for comparison in the reproductions of 200

children diagnosed as needing psychotherapy and 200 children independently judged to be well-adjusted by at least two adults. The groups were matched for sex distribution at each of four age levels (8 and 9, 10 and 11, 12 and 13, and 14 and 15 years). Of 60 chi square tests computed, 26 were found to be significant at the 0.05 level or beyond. Four of the factors differentiated the two groups of children at all age levels; these were, orderly sequence, change in curvature, closure difficulty and rotations. Two additional factors differentiated at all ages above ten years, i.e., overall change in size and angulation change. These latter two factors are closely related to the general concept of consistency as outlined in the present study.

Clawson (1959) extended Byrd's (1956) investigation to encompass a more definitive study of the projective uses of the test for personality appraisal of children. She made two major hypotheses, amplified by a number of subsidiary hypotheses: First, it was predicted that the kinds and amounts of deviations from the stimulus figures would be greater for clinic subjects and, secondly, that the deviations from the designs would be related to childhood disturbances. The experimental sample consisted of 80 children in a Guidance Centre presenting various adjustment problems. A control group of 80 children from

the public schools and judged by teachers to be normal was used for comparison. The groups were carefully matched for age, sex, I.Q. and socioeconomic status.

The results supported the first hypothesis, with 17 of the 37 factors investigated yielding significant differences between groups. Included in the 17 differentiating factors were change in size, change in angulation and change in curvature which had previously been reported as differentiating factors by Byrd (1956). These three factors are tangentally related to the concept of consistency employed in the present study, particularly when consistency is measured as deviation from the objective stimulus.

Several studies have indicated a relationship between age and Bender functioning. Excellent reviews of this literature are provided by Tolor and Schulberg, (1963) and Keogh (1970). Recently, Koppitz (1963), presented a developmental Bender scoring system based on specific deviations which appear to be related to visual motor maturity. Although she examined several developmental trends in the reproduction of BVMGT designs, Koppitz (1953) did not consider factors related to consistency.

The Hypotheses

It was hypothesized that:

1. Maladjusted children would show greater inconsistency in reproduction of the BVMGT design properties than would children who were not maladjusted.
2. Consistency of the reproduction of BVMGT design properties would be age dependent, with reproductions of older children showing greater consistency than those of younger children.

While hypotheses were not made with respect to sex differences, the study was designed in such a way as to permit an examination of possible sex differences and interactions among the adjustment, age and sex factors.

METHOD

Subjects

One hundred and twenty subjects were included in the study, 60 of whom were defined as maladjusted and 60 as adjusted. Each of these samples consisted of 20 subjects (10 male and 10 female) in each of the following age groups:

(a) 8 years, 0 months - 9 years, 11 months

(b) 10 years, 0 months - 11 years, 11 months

(c) 12 years, 0 months - 13 years, 11 months

With the exception of three subjects, the maladjusted sample was selected from children who had been assessed for admission to the Emotionally Disturbed Children's Unit at The Glenrose School Hospital, Edmonton, Alberta. Due to a lack of suitable female subjects in the youngest category, three females in this age group were selected from those admitted to a psychiatric ward at the University of Alberta Hospital, Edmonton, Alberta. All subjects in the maladjusted sample had obtained a full scale I.Q. in the 85 - 115 range on the Wechsler Intelligence Scale for Children, and, so far as could be determined, were not receiving medication at the time of assessment.

The subjects in the adjusted sample were selected from students attending public school classes in Camrose, Alberta (population approximately 9,000) located 60 miles from Edmonton. All subjects selected had obtained I.Q.'s in the 85 - 115 range on the Raven's Progressive Matrices Test. The Colored Progressive Matrices (1956) were used for 8 - 10 year olds and the Standard Progressive Matrices (1956) for 10 - 14 year olds). Additionally, those subjects included in the adjusted sample were in the appropriate grade placement for their age. They were identified by their teachers as not demonstrating specific learning disabilities or presenting behavior problems in the classroom, and had no school record indicating previous referral to a school counsellor or other social service agency.

Procedure

Following group administrations of the Ravens Progressive Matrices Test (RPMT) to a total of 174 children in the classroom setting and after consultation with teachers, 60 children who met the study's criteria for adjusted subjects were individually administered the BVMGT. The author followed standard procedure for this administration, using the following instructions:

I am going to show you these (pointing at stack

> of Bender Gestalt cards) cards one at a time. Each card has a design on it. I would like you to copy the design on this sheet of paper as accurately as you can. Here is the first one. (Present first card). Now go ahead and make one just like it.

It should be noted that prior to the administration of the RPMT in the classroom, the children had been informed of the author's purposes:

> The test (RPMT) you will be taking this morning is part of a research project and the results of the test will be confidential - known only to me. In connection with this same research project, I will be asking some of you to complete another task later on this week.

BVMGT protocols for the maladjusted subjects were obtained from existing files at the Glenrose Hospital where the test is commonly administered as part of the psychological assessment of children being considered for admission to the Emotionally Disturbed Childrens' Unit. Exceptions were the three female subjects mentioned previously. BVMGT protocols for these subjects were obtained from files at the University of Alberta Hospital.

Scoring

Measurements were obtained on the nine property linkages outlined earlier (on page 2), using dividers (HOCO), a millimeter scale (Geotee #3248182), a protractor (Hugh-Owens), and a metric circle template (RapiDesign

#2140). In most instances, the dividers were used to ascertain the property size, which was then measured against the millimeter scale which provided for calculation to the nearest millimeter. Exceptions to this procedure occurred for linkages 2, 8 and 9 (Figures 2, 8 and 9). For linkage 2, the metric circle template was used to determine the diameter of the circular figures. The protractor was used to measure the angle sizes for linkages 8 and 9. Appendix A contains the record forms on which measures - "Measurements and Deviations" and calculations - "Final Calculation" - were recorded. Deviations from the objective stimulus size were calculated. The size of the initial stimulus property reproduction for each linkage was determined and deviations of subsequent property sizes from this standard were calculated and recorded in absolute numbers. Mean deviations from each of the above standards were calculated for each of the nine property linkages resulting in 18 mean deviation scores for each subject. These served as the measures included in the various analyses.

To obtain an estimate of interscorer reliability 24 protocols were selected randomly (2 from each of the 12 Age x sex x Adjustment categories) and scored independently by a naive individual. Pearson Product-Moment correlation co-efficients were computed on the two sets of scores,

yielding interscorer reliability estimates ranging from .98 to .99 for the 18 linkage scores. These are presented in Table 1.

TABLE 1

Pearson Correlation Coefficients for Interscorer Reliability

Linkage[a]	r	Linkage	r
1	0.99	1a	0.99
2	0.99	2a	0.98
3	0.99	3a	0.99
4	0.99	4a	0.99
5	0.99	5a	0.99
6	0.99	6a	0.99
7	0.98	7a	0.98
8	0.99	8a	0.99
9	0.99	9a	0.99

[a]Linkages 1 - 9 represent deviations from the objective stimulus properties. 1a - 9a represent deviations from the initial stimulus properties reproduced by the subject for each of the 9 linkages.

The objective scoring system clearly proved to be highly reliable.

<u>Analysis</u>

To test the adjustment and developmental hypotheses a 3 x 2 x 2 analysis of variance was carried out for each

of the 18 scores. Additionally, the data for each of the adjusted and maladjusted groups was analyzed separately in a 3 x 2 analysis of variance in order to examine developmental trends within the two samples.

Where comparison of more than two means was involved and if a significant overall F was obtained, a Newman-Keuls Test (Winer, 1962) was used to examine the specific nature of the differences between means.

RESULTS

Adjustment Hypothesis

The hypothesis that maladjusted children would show greater inconsistency (higher mean deviation scores) in their reproduction of the BVMGT design properties than would adjusted children was strongly supported. A three-way (Adjustment x Age x Sex) analysis of variance indicated significant differences between the groups on 17 of the 18 linkages. Complete results of the three way analysis of variance are contained in Appendix B. Mean deviation scores were significantly greater for maladjusted subjects on 17 of the 18 linkages (Table 2). The one exception was linkage 5a where the difference was in the predicted direction but failed to reach significance.

Developmental Hypothesis

It was hypothesized that consistency would be age-dependent, with the reproductions of older children showing greater consistency (lower mean deviation scores) than those of younger children. Results of the three way analysis of variance indicated a significant relationship between age and consistency on 7 of the 18 linkages (Appendix B), namely 1,2,5,6,7, and 8a. However, in view of

TABLE 2

Mean Deviation Scores for Adjusted and Maladjusted Subjects

Linkage[a]	Adjusted	Maladjusted	F	P
1	3.393	4.920	40.334	0.000
2	5.484	8.467	30.448	0.000
3	10.655	13.915	9.754	0.002
4	5.361	7.335	10.315	0.002
5	29.879	51.413	30.359	0.000
6	7.563	11.033	10.675	0.001
7	2.028	2.536	5.852	0.017
8	15.833	20.692	12.546	0.001
9	11.729	15.142	6.865	0.010
1a	3.547	5.211	17.462	0.000
2a	5.583	7.458	6.852	0.010
3a	16.088	20.071	3.960	0.049
4a	6.709	10.188	8.208	0.005
5a	25.434	28.578	0.470	0.494
6a	7.404	13.175	11.456	0.001
7a	1.902	2.646	7.898	0.006
8a	19.629	27.908	9.869	0.002
9a	11.875	17.217	10.207	0.002

[a]- Linkages 1-9 refer to mean deviation scores from the objective stimulus properties. 1a-9a refer to mean deviation scores from initial property reductions in each linkage.

the highly significant relationship found between consistency and adjustment, it seemed plausible that the inclusion of the maladjusted subjects in the examination of the developmental hypothesis, may have served to mask a relationship between age and performance.

Consequently, the developmental hypothesis was re-examined using a two way (Age x Sex) analysis of variance of scores for the adjusted subjects. Results showed a significant relationship between consistency and age on 11 of the 18 linkages, namely 1, 2, 3, 4, 6, 7, 8, 3a, 4a, 7a, and 8a. Complete results of the two way analysis of variance are contained in Appendix C.

Although a significant developmental effect was not found for seven of the linkages, it should be noted that, with the exception of linkage 5a, the oldest age group showed the greatest consistency in obtaining the smallest mean deviation scores (Table 3).

While the 12 - 14 year age group generally demonstrated greater consistency than one or both of the younger age groups, such a consistent trend is not evident when comparing the two younger age groups. Neuman-Keuls Tests (Table 3) indicated that none of the differences between the two younger age groups were significant and no consistent trend between the two groups was observable in the data.

TABLE 3

Mean Deviation Scores for 3 Age Groups
of Adjusted Subjects

Linkage[a]	Age			Newman-Keuls Test[b]
	8-10	10-12	12-14	
1	4.155	3.568	2.454	1-3; 2-3
2	6.383	5.783	4.283	1-3
3	12.588	12.468	6.908	1-3; 2-3
4	5.446	6.928	3.707	2-3
5	3.448	3.192	2.323	-
6	9.138	8.688	4.862	1-3; 2-3
7	2.157	2.477	1.448	1-3; 2-3
8	16.200	17.750	13.550	2-3
9	12.488	13.800	8.900	-
1a	4.008	3.638	2.994	-
2a	5.800	5.625	5.325	-
3a	18.175	20.175	9.912	1-3; 2-3
4a	7.627	7.921	4.577	c
5a	27.600	21.867	26.833	-
6a	7.150	8.338	6.725	-
7a	1.707	2.469	1.529	2-3
8a	22.524	23.675	12.688	1-3; 2-3
9a	15.275	13.250	9.100	-

[a]- Linkage 1-9 refer to mean deviation scores from objective stimulus properties, 1a-9a refer to mean deviation score from initial property reproduction in each linkage.

[b]- 1, 2 and 3 refer to 8-10, 10-12 and 12-14 year olds respectively. Significant group differences are indicated ($p < 0.05$).

[c]- Newman-Keul test failed to yield group differences significant at 0.05 level, although ANOVA indicated significant group differences.

On 10 linkages the 10 - 12 year olds showed greater consistency than the 8 - 10 year olds, while on the remaining 8 linkages the trend was reversed (Table 3).

A two way analysis of variance on maladjusted subjects data revealed no significant age group differences for any of the 18 linkages. Complete results of the two-way analysis of variance are contained in Appendix D.

A similar trend to that found in the adjusted group (12 - 14 year old group obtaining the lowest mean deviation scores) was observed on 10 of the 18 linkages (Table 4), namely, 1, 2, 3, 4, 5, 6, 9, 5a, 6a, and 8a.

<u>Adjustment x Age Interaction</u>

A significant interaction between adjustment and age was found for only two of the property linkages, 1 and 3a (Appendix B). This was somewhat surprising initially, in view of the significant age group differences found for adjusted subjects and the lack of significant differences for maladjusted subjects. As noted previously, a non-significant trend, similar to that obtained for adjusted subjects, existed for the maladjusted group. This fact may account for the relative absence of significant Adjustment x Age interactions.

A closer examination of the data, revealed a

TABLE 4

Mean Deviation Scores for 3 Age Groups of Maladjusted Subjects

Linkage[a]	Age 8 - 10	Age 10 - 12	Age 12 - 14
1	4.740	5.557	4.463
2	8.984	8.650	7.767
3	13.441	14.950	13.355
4	7.706	7.180	7.120
5	5.740	5.430	4.254
6	13.225	10.625	9.250
7	2.322	2.852	2.434
8	22.138	19.725	20.212
9	16.638	15.113	13.675
1a	4.332	6.027	5.273
2a	6.250	7.250	8.875
3a	16.000	22.700	21.513
4a	12.040	8.833	9.689
5a	31.467	31.817	22.450
6a	13.025	16.849	9.650
7a	2.394	2.844	2.700
8a	31.350	31.150	21.224
9a	20.549	14.850	16.250

[a]- Linkage 1-9 refer to deviations from the objective stimulus properties. 1a-9a refer to deviations from the initial property reductions in each linkage.

trend, although nonsignificant, in the expected direction. In addition to the 2 significant interactions obtained, the difference between maladjusted and adjusted subjects was greatest for the 12 - 14 year age group for 10 another linkages (Table 5).

It should be noted, that the validity of the 2 significant interactions is somewhat questionable. Sakoda, Cohen and Beall (1954), in examing the problems of evaluating a series of statistical tests, reported that the probability of obtaining 2 significant statistics by chance in a series of 18 tests was approximately 0.20.

Sex

Although no hypotheses were formulated with respect to sex differences, the design of the present study provided the opportunity to examine these in relation to consistency. The three way analysis of variance revealed a significant sex difference only for linkage 8 (Appendix B) where males showed greater consistency than females (mean deviation scores for males and females respectively were 16.513 and 20.012, $p < 0.05$). The probability of this one significant difference occurring by chance in a series of 18 tests was approximately 0.50 (Sakoda, Cohen and Beall, 1954).

A significant Adjustment x Sex interaction was

TABLE 5

Difference in Mean Deviation Scores Between Adjusted and Maladjusted Subjects

Linkage[a]	Age 8 - 10	Age 10 - 12	Age 12 - 14
1	0.585	1.990	2.009
2	2.601	2.866	3.484
3	0.583	2.492	6.447
4	2.260	0.252	3.413
5	2.292	2.238	1.931
6	4.087	1.939	4.388
7	0.165	0.375	0.986
8	5.938	1.975	6.662
9	4.150	1.313	4.775
1a	0.324	2.389	2.279
2a	0.450	1.625	3.550
3a	-2.175	2.525	11.601
4a	4.413	0.912	5.112
5a	3.867	9.950	-4.383
6a	5.875	8.511	2.925
7a	0.687	0.375	1.271
8a	8.826	7.475	8.536
9a	7.274	1.600	7.150

Note:- Differences refer to Adjusted minus Maladjusted.

[a]- Linkage 1-9 refer to deviations from objective stimulus properties, 1a-9a refer to deviation from initial property reproductions.

obtained for 5 of the 18 linkages (Appendix B), namely 4, 7, la, 6a and 7a. In all 5 instances, the difference between adjusted and maladjusted subjects was greater for males than females. This finding was supported by a similar trend, although nonsignificant on 10 additional linkages (Table 6).

When the two groups were examined independently, significant sex differences were found for the adjusted group for linkages 4, 7, 8, la and 9a (Appendix C). For all 5 linkages, males showed greater consistency than females. On 10 additional linkages, differences were in a similar direction but nonsignificant.

Within the maladjusted sample, significant sex differences occurred only for linkages la and 7a (Appendix D). In both instances, the differences were reversed from those found in the adjusted sample, with females showing greater consistency than males. Nonsignificant differences in a similar direction were found for 9 additional linkages.

Overall, the results regarding sex differences were quite ambiguous. There was evidence that the differences between adjusted and maladjusted subjects were greater for males than females but the lack of consistently significant results, makes it difficult to draw any conclusions.

TABLE 6

Difference in Mean Deviation Scores Between Adjusted and Maladjusted Subjects

Linkage[a]	Sex Male	Female	F
1	1.743	1.311	0.806
2	2.707	3.190	0.146
3	4.712	2.810	1.930
4	3.365	0.584	5.113*
5	23.017	20.049	0.144
6	3.700	3.242	0.047
7	1.051	-0.034	6.661*
8	5.375	4.341	0.142
9	3.766	3.058	0.074
1a	3.023	0.305	11.646**
2a	1.963	1.717	0.049
3a	7.017	0.950	2.297
4a	4.771	2.188	1.131
5a	2.590	3.700	0.015
6a	9.208	2.334	4.065*
7a	1.550	-0.060	9.236**
8a	6.550	10.008	0.430
9a	6.417	4.266	0.413

Note:- Differences refer to Adjusted minus Maladjusted.

*Significant at 0.05 level. **Significant at 0.001 level.

[a]- Linkages 1-9 refer to deviation from objective stimulus properties. 1a-9a refer to deviation from initial property reproductions.

DISCUSSION

The present study was designed to examine adjustment and developmental hypotheses with respect to the performance of adjusted and maladjusted children on the Bender-Gestalt Test. Specifically, it was hypothesized that maladjusted children would show greater inconsistency in their reproductions of stimulus properties of the BVMGT designs than would children who were not maladjusted. This hypothesis was strongly supported with the maladjusted group obtaining higher mean deviation scores on 17 of 18 linkages.

It is interesting to note that the one linkage (5a) which failed to yield significant differences between the two groups involved BVMGT figures 1 and 2. This particular linkage refers to the lengths of the rows of ovals in figure 2 and the length of the row of dots in figure 1, which are equal. It is unique in that figure 2 follows directly after figure 1 in presentation and the stimulus property is not embedded within a larger design as is the case with the other linkages. At present, one can only speculate about the significance of such considerations but further research into the relationship between consistency and such factors as location in sequence and embed-

dedness of properties may prove useful.

Secondly, it was hypothesized that consistency would be age-dependent, with older subjects showing greater consistency in their reproductions of the BVMGT design properties. Findings with respect to this hypothesis were much less clear-cut. When the total sample was examined, significant age group differences occurred for 7 of the 18 linkages. Independent analysis of the adjusted group alone yielded significant age group differences on 11 linkages. In each of these instances, the oldest group showed significantly greater consistency than one or both of the younger groups. Additionally, for 6 of the 7 linkages for which no significant age group differences were found, the older group showed a non-significant trend in the predicted direction. Differences between the 8 - 10 and 10 - 12 year old groups were not found to be significant for any of the 18 linkages, and no consistent trend between the two groups was evident.

Independent analysis of the maladjusted sample yielded no significant age group differences for any of the 18 linkages. There was, however, a nonsignificant trend similar to that found with adjusted subjects (lower mean deviation scores for the oldest age group) observed on 10 of the 18 linkages.

Results with respect to the developmental hypothesis were limited by the age range of the sample. Thus, it is possible that developmental changes occur prior to the age of 8 and after the age of 14.

Although differences with respect to the developmental hypothesis found between the adjusted and maladjusted subjects might lead on to expect significant Adjustment x Age interaction, this was found for only 2 of the 18 linkages. In both instances, the difference in performance for the two groups was greatest at the 12 - 14 year level. Such an interaction was generally absent, probably due to the similarity in trends noted between the two groups.

Previous research on the BVMGT has generally failed to yield significant sex differences (Tolor and Schulberg, 1963; Keogh, 1970). In the present study, a significant sex difference was found for only linkage 8. There is a high probability (0.50) that such a difference could occur by chance in a series of 18 statistical tests (Sakoda, Cohen and Beall, 1954).

A significant Adjustment x Sex interaction was obtained for 5 linkages and a similar nonsignificant trend found for 10 others. This finding suggests that when differences between maladjusted and adjusted subjects are examined, the relationship between consistency and maladjustment is stronger for males than females. The con-

fidence placed in this conclusion is limited due to the lack of consistently significant results and it is highly plausible that the finding may be an artifact of the particular samples selected for study. The possibility of such an interaction should be examined more fully in future research.

Consistency of the BVMGT design property reproductions was examined in relation to two types of stimuli; (a) the objective stimulus property as presented on the card, and (b) the subject's initial reproduction of the stimulus property in each linkage. The possibility exists that the two types of consistency are not highly related, in that subjects' reproductions might show high deviation from the objective stimulus but little deviation between reproductions. Direct comparisons between the two types of measures were not made; both measures of consistency appeared to be similarly related to maladjustment.

The developmental trend observed among adjusted subjects was more evident for deviation measures from the objective stimulus (7 out of 9 showing significant age differences) than it was for deviation measures from the initial property reproduction (4 out of 9 showing significant age differences). A similar nonsignificant trend was present for all measures with the exception of one.

Differences between the two types of measures were not observed with respect to the sex differences obtained.

On the basis of the findings of the present study, it is difficult to determine whether the two types of measures employed represent measures of a unitary concept. It would appear, however, that if they do measure different concepts, these are highly related.

Limitations of the Study and Suggestions for Further Research

An important limitation of the present study was the use of an extremely heterogeneous maladjusted sample. Diagnostic categories used in the area of child psychopathology are, at present, characteristically vague and unrevealing. There is little assurance, although several children have been admitted under the same diagnosis, that they present identical maladjusted behaviors with similar etiologies. Further, any attempt to limit the selection of subjects to children diagnosed under any one category, would have made it difficult, if not impossible, to obtain a sample large enough for study. Future research might attempt a more refined selection procedure - defining maladjustment more specifically in terms of type of behavior exhibited.

The lack of a behavioral definition of adjusted

subjects presents somewhat equivalent problems for the selection of a control group. Precautions taken in the present study probably served to eliminate severely maladjusted children from the control group but it would be difficult to determine precisely where the control group lay on an adjustment-maladjustment continuum.

The use of different intelligence tests for subject selection was another limitation. Ideally, all subjects should have been selected on the basis of the Wechsler Intelligence Scale for Children (WISC), since it is individually administered and more comprehensive normative data increases its validity as a measure of intelligence. WISC scores were not available for control group subjects and time considerations made impossible the administration of the WISC to the neccessary number of children for selection of the research sample.

A further problem for this research was presented by the dissimilar circumstances under which the two subject samples were administered by the BVMGT. The experience of children taking the test as part of a psychological assessment in a clinical setting is probably quite different from that of children who realize that the test is merely part of a research project, the results of which are unlikely to directly affect them in any way. It is impossible to evaluate the effects of these different

situations upon subject performance.

The results and conclusions of the present study, must be evaluated in light of these obvious limitations but the findings appear sufficiently strong to warrant further research.

The suggested relationship between consistency in the BVMGT designs and maladjustment may lead to a broadened understanding of the processes involved in BVMGT reproductions; the practical value, however, of these findings is not clear. In their present form, the measurements employed become a tedious and time consuming procedure. The possibility of shortening the procedure should be investigated.

Further, and more importantly, the discriminative validity of these measures should be improved. First, it should be determined which value for each measure serves to discriminate between maladjusted and non-maladjusted subjects. This would require more extensive research of the present procedure with large numbers of subjects who can be clearly identified as demonstrating maladjusted or non-maladjusted behavior. Researchers should attempt to refine the broad definition of maladjustment, differentiating among various etiological and/or behavioral categories when selecting subjects. With such research, it may be

possible to extend the diagnostic value of these measures in order to differentiate between various types of maladjustment. In addition, with comprehensive data, it may be possible to select a sample of the 18 measures with sufficiently high discriminative power, thereby decreasing the lengthiness of the present procedure. This would serve to facilitate its use for the researcher and clinician.

REFERENCES

Bender, L. A visual motor Gestalt Test and its clinical use. _American Orthopsychiatric Association Research Monograph_, 1938, No. 3.

Byrd, E. The clinical validity of the Bender-Gestalt Test with children. _Journal of Projective Techniques_, 1956, _20_, 127-136.

Clawson, A. The Bender Visual Motor Gestalt Test as an index of emotional disturbance in children. _Journal of Projective Techniques_, 1959, _23_, 198-206.

Hutt, M. Revised Bender Visual-Motor Gestalt Test. In A. Weider (Ed.), _Contributions toward medical psychology_. New York: Ronald, 1950.

Keogh, B. The Bender Gestalt with children: research implications. _Journal of Special Education_, 1970, _3_, 15-22.

Koppitz, E. _The Bender Gestalt Test for young children_. New York: Grune and Stratton, 1964.

Pascal, G.R. and Suttell, B.J. _The Bender-Gestalt Test: Its quantification and validity for adults_. New York: Grune and Stratton, 1951.

Spearman, D. Personal communication, University of Alberta, 1970.

Tolar, A. and Schulberg, H. _An evaluation of the Bender Gestalt Test_. Illinois: Thomas, 1963.

Wertheimer, W. Studies in the theory of Gestalt Pschology. _Psychologische Forschung_, 1923, _4_, 301-350. Cited by L. Bender, A visual motor Gestalt Test and its clinical use. _American Orthopsychiatric Association Research Monograph_, 1938, No. 3.

Winer, B. _Statistical principles in experimental design_. New York: McGraw-Hill, 1962.

APPENDIX A

SCORING RECORD SHEETS

MEASUREMENTS AND DEVIATIONS

Linkage	Design	Mst	ofs-	mfs-
1.(ofs: 18mm)	A.a	___	___	
	b	___	___	
	c	___	___	
	d	___	___	
	A T+l	___	___	
	X	___	___	
	4.a	___	___	___
	b	___	___	___
	c	___	___	___
	4 Ttl	___	___	___
	X	___	___	___
	7.a	___	___	___
	b	___	___	___
	c	___	___	___
	d	___	___	___
	7 Ttl	___	___	___
	X	___	___	___
	8.a	___	___	___
	b	___	___	___
	c	___	___	___
	d	___	___	___
	8 Ttl	___	___	___
	X	___	___	___
2.(ofs: 25mm)	A	___	___	
	4.	___	___	___
	5.	___	___	___
3.(ofs: 45mm)	3.	___	___	
	4.	___	___	___
	8.a	___	___	___
	b	___	___	___
	8 Ttl	___	___	___
	X	___	___	___
4.(ofs: 22mm)	5.	___	___	
	7.a	___	___	___
	b	___	___	___
	c	___	___	___
	d	___	___	___
	7 Ttl	___	___	___
	X	___	___	___

Linkage	Design	Mst	ofs-	mfs-
	8.a	___	___	___
	b	___	___	___
	c	___	___	___
	d	___	___	___
	8 Ttl	___	___	___
	X	___	___	___
5.(ofs: 130mm)	1.	___	___	
	2.a	___	___	___
	b	___	___	___
	c	___	___	___
	2 Ttl	___	___	___
	X	___	___	___
6.(ofs: 38mm)	4.	___	___	
	6.a	___	___	___
	b	___	___	___
	6 Ttl	___	___	___
	X	___	___	___
7.(ofs: 8mm)	7.a	___	___	
	b	___	___	
	c	___	___	
	d	___	___	
	7 Ttl	___	___	
	X	___	___	
	8.a	___	___	___
	b	___	___	___
	c	___	___	___
	d	___	___	___
	8 Ttl	___	___	___
	X	___	___	___
8.(ofs: 120^{o})	7.a	___	___	
	b	___	___	
	7 Ttl	___	___	
	X	___	___	
	8.a	___	___	___
	b	___	___	___
	8 Ttl	___	___	___
	x	___	___	___

Linkage	Design	Mst	ofs-	mfs-
9. (ofs: 47°)	7.a	___	___	
	b	___	___	
	7 Ttl	___	___	
	X	___	___	
	8.a	___	___	___
	b	___	___	___
	8 Ttl	___	___	___
	X	___	___	___

FINAL CALCULATION OF SCORES

LINKAGE	DESIGN	OFS-	MFS-
1.	A.	_____	_____
	4.	_____	_____
	7.	_____	_____
	8.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
2.	A.	_____	
	4.	_____	_____
	5.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
3.	3.	_____	
	4.	_____	_____
	8.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
4.	5.	_____	
	7.	_____	_____
	8.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
5.	1.	_____	
	2.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
6.	4.	_____	
	6.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
7.	7.	_____	
	8.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____

LINKAGE	DESIGN	OFS-	MFS-
8.	7.	_____	
	8.	_____	_____
	Totals	_____	_____
	X Scores	_____	_____
9.	7.	_____	
	8.	_____	_____
	Totals	_____	_____

APPENDIX B

2 x 3 x 2 ANALYSIS OF VARIANCE

Linkage 1

Source	df	MS	F	p
A (Adjustment)	1	70.014	40.334	0.000
B (Age)	2	14.726	8.483	0.000
C (Sex)	1	0.867	0.499	0.481
AxB	2	6.666	3.840	0.025
BxC	2	1.004	0.578	0.563
AxC	1	1.400	0.806	0.371
AxBxC	2	3.523	2.030	0.136
Errors	108	1.725		

Linkage 2

Source	df	MS	F	p
A (Adjustment)	1	267.015	30.448	0.000
B (Age)	2	29.275	3.338	0.039
C (Sex)	1	0.489	0.056	0.814
AxB	2	2.048	0.234	0.791
BxC	2	0.162	0.019	0.982
AxC	1	1.277	0.146	0.703
AxBxC	2	1.410	0.161	0.852
Errors	108	8.770		

Linkage 3

Source	df	MS	F	p
A (Adjustment)	1	318.976	9.574	0.002
B (Age)	2	143.968	4.402	0.015
C (Sex)	1	0.926	0.028	0.867
AxB	2	82.771	2.531	0.084
BxC	2	30.937	0.946	0.391
AxC	1	63.133	1.930	0.168
AxBxC	2	81.943	2.506	0.086
Errors	108	32.703		

Linkage 4

Source	df	MS	F	p
A (Adjustment)	1	116.984	10.315	0.002
B (Age)	2	28.472	2.510	0.086
C (Sex)	1	14.826	1.307	0.255
AxB	2	25.590	2.256	0.109
BxC	2	8.243	0.727	0.486
AxC	1	57.990	5.113	0.026
AxBxC	2	23.635	2.084	0.129
Errors	108	11.342		

Linkage 5

Source	df	MS	F	p
A (Adjustment)	1	13910.400	30.359	0.000
B (Age)	2	1885.570	4.115	0.019
C (Sex)	1	60.253	0.131	0.718
AxB	2	37.835	0.083	0.921
BxC	2	263.004	0.574	0.565
AxC	1	66.021	0.144	0.705
AxBxC	2	265.169	0.579	0.562
Errors	108	458.202		

Linkage 6

Source	df	MS	F	p
A (Adjustment)	1	361.400	10.675	0.001
B (Age)	2	174.008	5.140	0.007
C (Sex)	1	30.251	0.894	0.347
AxB	2	17.858	0.528	0.592
BxC	2	7.433	0.220	0.803
AxC	1	1.576	0.047	0.830
AxBxC	2	90.533	2.674	0.074
Errors	108	33.855		

Linkage 7

Source	df	MS	F	p
A (Adjustment)	1	7.757	5.852	0.017
B (Age)	2	5.285	3.987	0.021
C (Sex)	1	1.325	0.999	0.320
AxB	2	1.820	1.372	0.258
BxC	2	2.274	1.716	0.185
AxC	1	8.829	6.661	0.011
AxBxC	2	0.369	0.279	0.757
Errors	108	1.326		

Linkage 8

Source	df	MS	F	p
A (Adjustment)	1	708.102	12.546	0.001
B (Age)	2	59.095	1.047	0.356
C (Sex)	1	367.500	6.511	0.012
AxB	2	63.666	1.128	0.327
BxC	2	55.267	0.979	0.379
AxC	1	8.008	0.142	0.707
AxBxC	2	11.444	0.203	0.817
Errors	108	54.440		

Linkage 9

Source	df	MS	F	p
A (Adjustment)	1	349.354	6.865	0.010
B (Age)	2	138.519	2.722	0.070
C (Sex)	1	48.451	0.952	0.331
AxB	2	34.051	0.669	0.514
BxC	2	3.485	0.068	0.934
AxC	1	3.763	0.074	0.786
AxBxC	2	19.082	0.375	0.688
Errors	108	50.892		

Linkage 1a

Source	df	MS	F	p
A (Adjustment)	1	83.051	17.462	0.000
B (Age)	2	6.194	1.302	0.276
C (Sex)	1	6.861	1.444	0.232
AxB	2	13.503	2.839	0.062
BxC	2	4.642	0.976	0.380
AxC	1	55.392	11.646	0.001
AxBxC	2	6.036	1.269	0.285
Errors	108	4.756		

Linkage 2a

Source	df	MS	F	p
A (Adjustment)	1	105.469	6.852	0.010
B (Age)	2	11.765	0.764	0.468
C (Sex)	1	6.769	0.440	0.509
AxB	2	24.494	1.591	0.208
BxC	2	1.881	0.122	0.885
AxC	1	0.752	0.049	0.825
AxBxC	2	9.777	0.635	0.532
Errors	108	15.393		

Linkage 3a

Source	df	MS	F	p
A (Adjustment)	1	476.008	3.960	0.049
B (Age)	2	357.258	2.972	0.055
C (Sex)	1	5.419	0.045	0.832
AxB	2	490.327	4.079	0.020
BxC	2	44.444	0.370	0.692
AxC	1	276.033	2.297	0.133
AxBxC	2	187.908	1.563	0.214
Errors	108	120.199		

Linkage 4a

Source	df	MS	F	p
A (Adjustment)	1	363.146	8.208	0.005
B (Age)	2	73.062	1.651	0.197
C (Sex)	1	0.005	0.001	0.992
AxB	2	50.651	1.115	0.322
BxC	2	50.208	1.135	0.325
AxC	1	50.039	1.131	0.290
AxBxC	2	59.859	1.353	0.263
Errors	108	44.242		

Linkage 5a

Source	df	MS	F	p
A (Adjustment)	1	296.676	0.470	0.495
B (Age)	2	240.065	0.380	0.685
C (Sex)	1	5.342	0.008	0.927
AxB	2	517.497	0.819	0.443
BxC	2	2984.920	4.727	0.011
AxC	1	9.252	0.015	0.904
AxBxC	2	509.386	0.807	0.449
Errors	108	631.488		

Linkage 6a

Source	df	MS	F	p
A (Adjustment)	1	999.075	11.456	0.001
B (Age)	2	195.375	2.240	0.111
C (Sex)	1	65.638	0.752	0.388
AxB	2	78.131	0.896	0.411
BxC	2	321.818	0.369	0.692
AxC	1	354.492	4.065	0.046
AxBxC	2	104.180	1.195	0.307
Errors	108	87.214		

Linkage 7a

Source	df	MS	F	p
A (Adjustment)	1	16.636	7.898	0.005
B (Age)	2	4.434	2.105	0.127
C (Sex)	1	1.555	0.738	0.392
AxB	2	1.163	0.766	0.468
BxC	2	0.801	0.380	0.684
AxC	1	19.457	9.236	0.003
AxBxC	2	0.736	0.349	0.706
Errors	108	2.106		

Linkage 8a

Source	df	MS	F	p
A (Adjustment)	1	2056.340	9.869	0.002
B (Age)	2	1394.560	6.693	0.002
C (Sex)	1	99.463	0.477	0.491
AxB	2	5.057	0.024	0.976
BxC	2	54.494	0.286	0.752
AxC	1	89.701	0.430	0.513
AxBxC	2	32.182	0.154	0.857
Errors	108	208.370		

Linkage 9a

Source	df	MS	F	p
A (Adjustment)	1	856.001	10.207	0.002
B (Age)	2	18.694	2.229	0.113
C (Sex)	1	271.502	3.237	0.075
AxB	2	105.039	1.253	0.290
BxC	2	57.890	0.690	0.504
AxC	1	34.669	0.413	0.522
AxBxC	2	106.481	1.270	0.285
Errors	108	83.863		

APPENDIX C

3 x 2 ANALYSIS OF VARIANCE

(Adjusted Subjects)

Linkage 1

Source	df	MS	F	p
A (Age)	2	14.928	17.216	0.000
B (Sex)	1	0.032	0.036	0.850
AxB	2	3.481	4.014	0.024
Error	54	0.867		

Linkage 2

Source	df	MS	F	p
A (Age)	2	23.403	3.722	0.031
B (Sex)	1	0.092	0.015	0.904
AxB	2	0.674	0.107	0.899
Error	54	6.287		

Linkage 3

Source	df	MS	F	p
A (Age)	2	210.655	9.169	0.000
B (Sex)	1	39.668	1.727	0.194
AxB	2	27.593	1.201	0.309
Error	54	22.749		

Linkage 4

Source	df	MS	F	p
A (Age)	2	51.983	7.107	0.002
B (Sex)	1	65.730	8.987	0.004
AxB	2	26.089	3.567	0.035
Error	54	7.314		

Linkage 5

Source	df	MS	F	p
A (Age)	2	695.233	2.002	0.145
B (Sex)	1	126.200	0.363	0.549
AxB	2	168.005	0.484	0.619
Error	54	347.728		

Linkage 6

Source	df	MS	F	p
A (Age)	2	110.362	6.735	0.002
B (Sex)	1	9.009	0.550	0.462
AxB	2	27.950	1.706	0.191
Error	54	16.386		

Linkage 7

Source	df	MS	F	p
A (Age)	2	5.545	5.696	0.006
B (Sex)	1	8.497	8.729	0.005
AxB	2	2.123	2.181	0.123
Error	54	0.973		

Linkage 8

Source	df	MS	F	p
A (Age)	2	90.214	3.109	0.053
B (Sex)	1	242.002	8.341	0.006
AxB	2	51.954	1.791	0.177
Error	54	29.014		

Linkage 9

Source	df	MS	F	p
A (Age)	2	128.675	2.911	0.063
B (Sex)	1	39.608	0.896	0.348
AxB	2	6.622	0.150	0.861
Error	54	44.205		

Linkage 1a

Source	df	MS	F	p
A (Age)	2	5.266	2.833	0.068
B (Sex)	1	11.625	6.255	0.015
AxB	2	10.500	5.649	0.006
Error	54	1.859		

Linkage 2a

Source	df	MS	F	p
A (Age)	2	1.154	0.092	0.912
B (Sex)	1	6.016	0.481	0.491
AxB	2	1.904	0.152	0.859
Error	54	12.517		

Linkage 3a

Source	df	MS	F	p
A (Age)	2	591.957	5.504	0.007
B (Sex)	1	179.402	1.668	0.202
AxB	2	57.363	0.533	0.590
Error	54	107.545		

Linkage 4a

Source	df	MS	F	p
A (Age)	2	68.582	3.360	0.042
B (Sex)	1	24.537	1.202	0.278
AxB	2	19.789	0.970	0.386
Error	54	20.412		

Linkage 5a

Source	df	MS	F	p
A (Age)	2	193.701	0.300	0.742
B (Sex)	1	143.359	0.022	0.882
AxB	2	2202.793	3.411	0.040
Error	54	645.743		

Linkage 6a

Source	df	MS	F	p
A (Age)	2	13.970	0.350	0.706
B (Sex)	1	57.526	1.441	0.235
AxB	2	23.282	0.583	0.561
Error	54	39.907		

Linkage 7a

Source	df	MS	F	p
A (Age)	2	4.990	3.344	0.043
B (Sex)	1	5.005	3.354	0.073
AxB	2	1.534	1.028	0.365
Error	54	1.492		

Linkage 8a

Source	df	MS	F	p
A (Age)	2	729.411	4.748	0.013
B (Sex)	1	0.122	0.001	0.978
AxB	2	63.388	0.413	0.664
Error	54	153.627		

Linkage 9a

Source	df	MS	F	p
A (Age)	2	115.512	2.136	0.128
B (Sex)	1	250.103	5.625	0.036
AxB	2	5.554	0.103	0.903
Error	54	54.076		

APPENDIX D

3 x 2 ANALYSIS OF VARIANCE

(Maladjusted Subjects)

Linkage 1

Source	df	MS	F	p
A (Age)	2	6.463	2.482	0.093
B (Sex)	1	2.235	0.858	0.358
AxB	2	1.047	0.402	0.671
Error	54	2.604		

Linkage 2

Source	df	MS	F	p
A (Age)	2	7.922	0.704	0.499
B (Sex)	1	1.672	0.149	0.701
AxB	2	8.986	0.080	0.923
Error	54	11.251		

Linkage 3

Source	df	MS	F	p
A (Age)	2	16.090	0.379	0.686
B (Sex)	1	24.392	0.575	0.452
AxB	2	85.287	2.010	0.144
Error	54	42.430		

Linkage 4

Source	df	MS	F	p
A (Age)	2	2.079	0.135	0.874
B (Sex)	1	7.086	0.461	0.500
AxB	2	5.788	0.377	0.688
Error	54	15.368		

Linkage 5

Source	df	MS	F	p
A (Age)	2	1228.170	2.158	0.125
B (Sex)	2	0.029	0.000	0.994
AxB	2	360.173	0.633	0.535
Error	54	569.125		

Linkage 6

Source	df	MS	F	p
A (Age)	2	81.501	1.588	0.214
B (Sex)	1	22.810	0.444	0.508
AxB	2	70.017	1.364	0.264
Error	54	51.323		

Linkage 7

Source	df	MS	F	p
A (Age)	2	1.559	0.930	0.401
B (Sex)	1	1.656	0.987	0.325
AxB	2	0.520	0.310	0.735
Error	54	1.678		

Linkage 8

Source	df	MS	F	p
A (Age)	2	32.542	0.388	0.680
B (Sex)	1	133.501	1.592	0.212
AxB	2	14.757	0.176	0.839
Error	54	83.865		

Linkage 9

Source	df	MS	F	p
A (Age)	2	43.891	0.762	0.472
B (Sex)	1	12.603	0.219	0.642
AxB	2	15.945	0.277	0.759
Error	54	57.579		

Linkage 1a

Source	df	MS	F	p
A (Age)	2	14.432	1.886	0.162
B (Sex)	1	50.636	6.616	0.013
AxB	2	0.178	0.023	0.977
Error	54	7.653		

Linkage 2a

Source	df	MS	F	p
A (Age)	2	1.503	0.082	0.775
B (Sex)	1	35.104	1.922	0.156
AxB	2	9.754	0.534	0.589
Error	54	18.267		

Linkage 3a

Source	df	MS	F	p
A (Age)	2	255.623	1.924	0.156
B (Sex)	1	102.051	0.768	0.385
AxB	2	174.988	1.317	0.276
Error	54	132.852		

Linkage 4a

Source	df	MS	F	p
A (Age)	2	55.132	0.810	0.450
B (Sex)	1	25.503	0.375	0.543
AxB	2	90.278	1.326	0.274
Error	54	68.071		

Linkage 5a

Source	df	MS	F	p
A (Age)	2	563.873	0.914	0.407
B (Sex)	1	0.281	0.000	0.983
AxB	2	1291.535	2.092	0.133
Error	54	617.234		

Linkage 6a

Source	df	MS	F	p
A (Age)	2	259.536	1.929	0.155
B (Sex)	1	362.599	2.696	0.106
AxB	2	113.079	0.841	0.437
Error	54	134.520		

Linkage 7a

Source	df	MS	F	p
A (Age)	2	1.057	0.388	0.680
B (Sex)	1	16.006	5.883	0.019
AxB	2	0.003	0.001	0.999
Error	54	2.720		

Linkage 8a

Source	df	MS	F	p
A (Age)	2	670.201	2.547	0.088
B (Sex)	1	189.031	0.718	0.400
AxB	2	28.287	0.108	0.898
Error	54	263.106		

Linkage 9a

Source	df	MS	F	p
A (Age)	2	176.462	1.553	0.221
B (Sex)	1	56.062	0.493	0.485
AxB	2	158.817	1.397	0.256
Error	54	113.649		